Waves

8-6 The student will demonstrate an understanding of the properties and behaviors of waves. (Physical Science)

8-6.2 Distinguish between mechanical and electromagnetic waves.
Taxonomy level: 4.1-B Apply Conceptual Knowledge

Previous/Future knowledge: Students have not been introduced to the concept of mechanical and electromagnetic waves in previous grades. Students will further develop the concepts of the different types of waves in high school Physical Science (PS-7.1-2).

It is essential for students to know the following characteristics of mechanical and electromagnetic waves:
Mechanical waves

- *Mechanical waves* require the particles of the medium to vibrate in order for energy to be transferred.
- For example, water waves, earthquake/seismic waves, sound waves, and the waves that travel down a rope or spring are also mechanical waves.
- Sound waves, as with all mechanical waves, cannot be transferred or transmitted through empty space *(vacuum*).

Electromagnetic waves

- *Electromagnetic waves* are waves that can travel through matter or empty space where matter is not present.
- Some examples are radio waves, microwaves, infrared rays, visible light, ultraviolet rays and x-rays that all travel in *electromagnetic waves*.

Another way to classify waves is by how they move:

- Mechanical waves in which the particles of matter in the medium vibrate by pushing together and moving apart parallel to the direction in which the wave travels are called *compressional* or *longitudinal waves*. The place on the wave that is pushed together is called the *compression* and the place that is moving apart is the *rarefaction*. Examples of mechanical compressional/longitudinal waves might include sound waves and some seismic waves.
- Mechanical waves in which the particles of matter in the medium vibrate by moving back and forth and perpendicular (at right angles) to the direction the wave travels are called *transverse waves*. The highest point of a transverse wave is the *crest* and the lowest point is called a *trough*. Examples of mechanical transverse waves might include some waves in a slinky spring, waves on a rope, strings in a musical instrument, and some seismic waves
- Electromagnetic waves are transverse waves that can travel without a medium through empty space.

It is not essential for students to know that electromagnetic waves are caused by vibrating electric charges, or that they transfer energy between vibrating electric and magnetic fields.

Waves

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Assessment Guidelines:

The objective of this indicator is to *distinguish* between mechanical and electromagnetic waves*;* therefore, the primary focus of assessment should be to make distinctions between the characteristics of electromagnetic and mechanical waves. However, appropriate assessments should require students to *compare* electromagnetic and mechanical waves; *classify* waves as mechanical or electromagnetic based on their characteristics; *exemplify* types of mechanical and electromagnetic waves and/or compressional and transverse waves; or *compare* ways that waves can move.